UNIVERSITY OF SASKATCHEWAN

Department of Physics and Engineering Physics

Physics 111.6
MIDTERM TEST #4

March 8, 2001 Time: 90 minutes

NAME: _____ STUDENT NO.: _____
(Last) **Please Print** (Given)

LECTURE SECTION (please circle):

01	Dr. R.E. Pywell
02	B. Zulkoskey
03	Dr. G.R. Davis
97	M. Gibson
C41	A. Duffy
C15	A. Duffy

INSTRUCTIONS:

1. You should have a test paper, a formula sheet, and an OMR sheet. The test paper consists of 9 pages. **It is the responsibility of the student to check that the test paper is complete**.
2. Enter your name and STUDENT NUMBER on the OMR sheet.
3. The test paper, the formula sheet and the OMR sheet must all be submitted.
4. The test paper will be returned. The formula sheet and the OMR sheet will NOT be returned.

PLEASE DO NOT WRITE ANYTHING ON THIS TABLE

QUESTION NUMBER	MAXIMUM MARKS	MARKS OBTAINED
Part A	10	
Part B	10	
C1	5	
C2	5	
C3	5	
TOTAL	35	

continued on page 2 ...

PART A

FOR EACH OF THE FOLLOWING QUESTIONS IN PART A, ENTER THE MOST APPROPRIATE RESPONSE ON THE OMR SHEET.

A1. Which one of the following is a correct unit for electric potential?

(A) eV / C.
(B) N / C.
(C) V / m.
(D) C / s.
(E) J ∫m.

A2. Electric field lines

(A) always point from low potential to high potential.
(B) always point from negative charges to positive charges.
(C) always point from north poles to south poles.
(D) always cross each other at right angles.
(E) always cross equipotential surfaces at right angles.

A3. A piece of copper wire, of length L and diameter d, has a resistance R. A second piece of copper wire is twice as long as, and has half the diameter of, the first piece. What is the resistance of the second piece of copper wire?

(A) R
(B) 2R
(C) 4R
(D) 8R
(E) R/2

A4. An electron moving eastward enters a region where there is a magnetic field directed upward. The initial direction of the magnetic force on the electron is

(A) down.
(B) west.
(C) north.
(D) south.
(E) up.

A5. Consider a ray of light in water that strikes a water-air interface at an angle of incidence less than the critical angle. Which one of the following statements is correct?

(A) The ray of light partially reflects into the water and partially transmits into the air; the angle of refraction is greater than the angle of incidence.
(B) The ray of light partially reflects into the water and partially transmits into the air; the angle of refraction is less than the angle of incidence.
(C) The ray of light totally transmits into the air; the angle of refraction is greater than the angle of incidence.
(D) The ray of light totally transmits into the air; the angle of refraction is less than the angle of incidence.
(E) The ray of light totally reflects into the water.

continued on Page 3…

A6. The dependence of the refractive index of a material on the wavelength of the incident light is known as

(A) refraction.
(B) reflection.
(C) polarization.
(D) transmission.
(E) dispersion.

A7. A single diverging lens can form only

(A) enlarged and inverted images.
(B) reduced and inverted images.
(C) reduced and virtual images.
(D) enlarged and real images.
(E) enlarged and virtual images.

A8. In a scene from a movie, a nearsighted character removes his glasses and uses them to focus the nearly-parallel rays from the sun to start a fire. What is physically wrong with this scene?

(A) Parallel rays cannot be focused.
(B) The glasses have diverging lenses and cannot be used to focus parallel rays.
(C) The glasses have converging lenses and cannot be used to focus parallel rays.
(D) Sunlight cannot be used to start a fire.
(E) A fire can only be started if the image of the sun is virtual.

A9. A person wears eyeglasses with a power of –4.00 diopters to correct his eyesight so that he can see clearly at distances between 25.0 cm and infinity. Which one of the following statements is correct?

(A) He is myopic and his uncorrected far point is at infinity.
(B) He is myopic and his uncorrected near point is less than 25.0 cm.
(C) He is hyperopic and his uncorrected near point is greater that 25.0 cm.
(D) He is hyperopic and his uncorrected far point is not at infinity.
(E) He is hyperopic and his uncorrected near point is less than 25.0 cm

A10. When viewing the moon through a simple, two-lens astronomical telescope we see craters that appear 10 times wider than they appear with the unaided eye. If the eyepiece has a focal length d, what must the focal length of the objective lens be?

(A) $10d$
(B) $100d$
(C) $\sqrt{10}d$
(D) $d / \sqrt{10}$
(E) $d / 10$

continued on page 4 ...

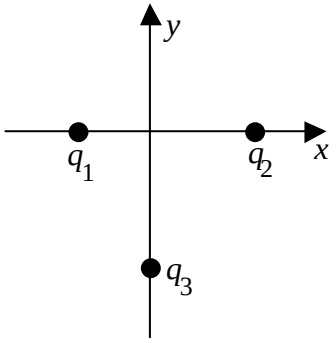
PART B

FOR EACH OF THE FOLLOWING PROBLEMS, B1 TO B5, ON PAGES 4 TO 6, WORK OUT THE SOLUTION IN THE SPACE PROVIDED AND ENTER YOUR ANSWERS ON PAGE 6.

ONLY THE ANSWERS WILL BE MARKED. THE SOLUTIONS WILL NOT BE MARKED.

B1. At a distance of 0.140 m from a point charge q, the magnitude of the electric field is $1.62 \Delta 10^6$ N/C. What is the magnitude of the charge q?

B2. Three point charges are placed in the xy-plane as shown.
Charge q_1 = +3.60 σC, at x = –2.00 cm, y = 0;
Charge q_2 = +6.00 σC, at x = 3.00 cm, y = 0;
Charge q_3 = –20.0 σC, at x = 0, y = –4.00 cm.
Determine the value of the absolute electric potential at the origin.



continued on page 5 ...

B3. A ray of light passes from a solid (with refractive index 1.55) to water (with refractive index 1.33). The angle of incidence of the ray is 35.0∀ What is the angle of refraction?

B4. The speed of light in benzene is $2.00 \Delta 10^8$ m/s. Calculate the critical angle at a benzene-air interface.

continued on page 6 ...

B5. Without his contact lenses, Mr. Lieffers can focus from 0.800 m to infinity. What power of lenses (in diopters) does he require for normal reading (with a book at 0.250 m from his eyes)?

ANSWERS FOR PART B

ENTER THE ANSWERS FOR THE PART B PROBLEMS IN THE BOXES BELOW.

THE ANSWERS MUST CONTAIN THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

ONLY THE ANSWERS WILL BE MARKED. THE SOLUTIONS WILL NOT BE MARKED.

B1 | |

B2 | |

B3 | |

B4 | |

B5 | |

continued on page 7 ...

PART C

IN EACH OF THE PART C QUESTIONS ON THE FOLLOWING PAGES, GIVE THE COMPLETE SOLUTION AND ENTER THE FINAL ANSWER IN THE BOX PROVIDED.

THE ANSWERS MUST CONTAIN THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

SHOW YOUR WORK – NO CREDIT WILL BE GIVEN FOR ANSWERS ONLY. EQUATIONS NOT PROVIDED ON THE FORMULAE SHEET MUST BE DERIVED.

USE THE BACK OF THE PREVIOUS PAGE FOR YOUR ROUGH WORK.

C1. Consider an electrical circuit in which an ideal AC voltage supply (with zero internal resistance) is connected to three loads in parallel. The rms voltage of the supply is 23.0 V and the resistances of the three loads are $R_1 = 4.00\ \Omega$, $R_2 = 7.00\ \Omega$ and $R_3 = 15.0\ \Omega$.

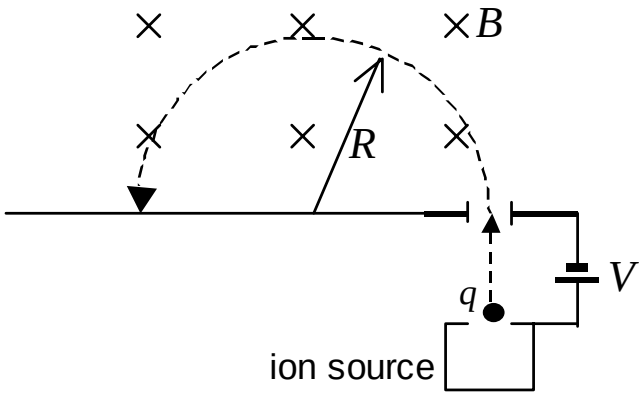
(a) Determine the rms current drawn from the supply.

(b) Determine the average power dissipation in the second load (R_2).

(c) Determine the peak current through the third load (R_3).

continued on page 8 ...

C2. In the form of mass spectrometer shown in the diagram, ions, with charge q and mass m, are accelerated by a voltage V, before they enter a region with magnetic field of magnitude B and direction perpendicular to the ions' velocity. The ions are assumed to start from rest. The ions travel in a circular path of radius R in the magnetic field.

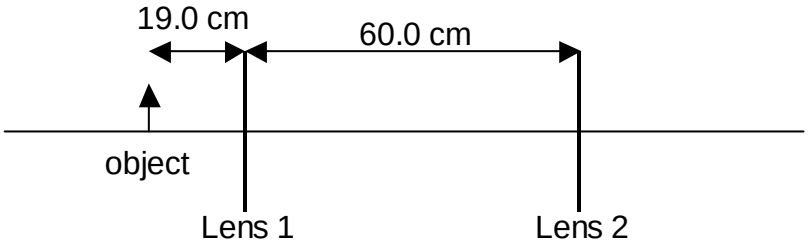


(a) Derive an expression for the speed of an ion as it enters the magnetic field region in terms of q, m and V.

(b) Derive an expression for the mass m of an ion in terms of q, V, B, and R.

continued on page 9 ...

C3. Two converging lenses, each having a focal length of 12.0 cm, are placed 60.0 cm apart. An object is placed 19.0 cm to the left of the first lens.



(a) Determine the location of the final image relative to lens 2.

(b) Determine the orientation and magnification of the final image relative to the original object.

Orientation: Upright / Inverted
Magnification:

END OF EXAMINATION